

How can Interoperability Support Process Mining in Healthcare?

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Abstract. A discussion of the relationship between the concept of healthcare information systems interoperability and process-oriented data analysis. The goal is to show that some of the current challenges of process mining in healthcare are also interoperability problems. By participating in solving these problems we can also improve our data sources.

Keywords: Interoperability · Process Mining · HL7 FHIR.

1 Introduction and Motivation

Modern healthcare depends on collaboration and communication across different specialized departments or even enterprises. Interoperability is the precondition for a seamless flow of information between the multiple actors involved, i.e., patients, medical personnel, and information systems [1].

Process mining provides an a-posteriori empirical, data-driven method to discover processes in observed system behavior, i.e., event logs of information systems. For the healthcare domain, recent reviews (e.g., [4]) list an increasing number of successful applications of process mining methods. However, these reviews also show that the majority of case studies do not take into account the particularities of structured health data.

Rebuge and Ferreira [3] conclude in their work that in healthcare both organizational processes and medical treatment processes are *highly dynamic, highly complex, increasingly multi-disciplinary* and *generally ad-hoc*. All four characteristics make it hard to apply process mining methods [3]. However, these characteristics are not new and not exclusively relevant for process mining, as they also present major challenges for interoperability and thus were important drivers for different standardization efforts [1].

2 Levels of Interoperability

Gibbons et al. [2] identified three interoperability classification types and for the lowest level, the term *technical interoperability* was chosen. Technical interoperability focuses on the conveyance of data, not on its meaning. Thus, messages or documents can be exchanged without any consideration of their contents.

Only based on technical interoperability, *semantic interoperability* can be reached. The communicating information systems must defer to a common information exchange reference model. Thus, enabling a common understanding of the *meaning* of the content in the exchanged messages or documents. Unambiguous codes and identifiers are the foundation for semantic interoperability [1].

The highest level, *process interoperability*, aims not only for the exchange of the information but also for the coordination of (business) processes. Gibbons et al. [2] conclude that “process interoperability is another way of talking about workflow management”. Oemig and Snelick [5] state that in order to reach the highest level of interoperability, the original information must be accompanied by additional metadata to steer and control the processing of data exchange.

We claim that this additional data can be a key resource for process mining, but it is important to know where to find it in future health information systems.

3 API Interoperability, HL7 FHIR

In 2010, Dolin and Alschuler [6] found that profile-driven implementations in a service-oriented architecture represent the state of the art in interoperability. However, there have been some major developments in healthcare IT in the last 10 years and a new form of interoperability is emerging based on APIs implemented using the RESTful paradigm – the HL7 FHIR standard [1].

There are data structures (resources) in HL7 FHIR for steering and for documenting the execution of workflows. They can be used to analyze healthcare processes from different perspectives. The first attempt to utilize HL7 FHIR for process mining [7] revealed some room for improvement. Our proposal to extend the AuditEvent and Provenance resources was reviewed and accepted for inclusion in the next FHIR release *R5* (<https://jira.hl7.org/browse/FHIR-28100>).

We encourage all researchers in the PODS4H community to actively participate in the development and shaping of new standards to improve our future data sources and thus process mining projects!

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